METHOD FOR THE SYNCHRONIZATION OF BASE STATIONS IN A MULTICELLULAR, WIRELESS TELEPHONE SYSTEM

BACKGROUND OF THE INVENTION

The present invention is directed to a method for synchronizing base stations in a multicellular, wireless telephone system, whereby the base stations are connected to a communication system via trunk lines.

Such a multicellular, wireless telephone system is disclosed in German Patent Application P 43 09 848.7 (corresponding to U.S. Ser. No. 214,570, filed Mar. 18, 1994 and hereby incorporated by reference) and is disclosed in the publication Telcom Report 8 (1985), No. 5, "Die Basisstation im zellularen Funkfernsprechnetz C450". A communication system, particularly a telecommunication private branch exchange, is connected via trunk lines to the base stations. Digitized voice and signaling information to be communicated from or to the communication terminal equipment, that is wirelessly connected to the base stations, is transmitted via the trunk lines. A communication of the synchronization information via the trunk lines is possible for base stations connected to a communication system by trunk lines. Phase deviations in the processing clock signals arise in the communication due to different trunk line running times and different processing speeds of the synchronization equipment that are realized in circuit-oriented terms. As a result phase deviations occur in the wireless or broadcast signals which cause particular disturbances in the coverage areas of the neighboring base stations.

A method for wireless synchronization of base stations for the radio telephone network C450 is described in another publication, Telcom Report 9 (1986), Special Issue "Nachrichtenuebertragung auf Funkwegen, pages 286–288, "Netzsynchronitaet im Mobilfunksystem C450". In this method, all other base stations are arranged around an initial base station in concentric rings. The initial base station wirelessly synchronizes the base stations of the first ring. The base stations of the first ring synchronize the base stations of the second ring, etc. Disturbances of the neighboring coverage areas are likewise possible due to different running times or phase deviations, particularly in neighboring base stations of one ring that are allocated to a common reference base station.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a method that avoids the disturbances in the coverage areas of the neighboring base stations caused by the phase deviations.

In general terms, the method of the present invention is for synchronization of base stations in a multicellular, wireless telephone system, whereby the base stations are connected to a communication system via trunk lines. Synchronization information is wirelessly transmitted from the base stations. The base stations are arranged at such a distance from one another that wirelessly received synchronization information can be at least partially received at least by one neighboring base station. The initial, wireless synchronization of all base stations in the multicellular, wireless telephone system and the wireless synchronization during operation are controlled by the communication system via the trunk lines such that one respective base station is synchronized onto the synchronization information transmitted from a neighboring base station.

Advantageous developments of the present invention are as follows.

Receivability of the wirelessly received synchronization signals is identified by a level measurement. In the level measurement, the level of the wirelessly received synchronization information is compared to a predetermined synchronization level and receivability information is formed insofar as the level of the wirelessly received synchronization information exceeds the synchronization level.

Given an initial synchronization controlled by the communication system all base stations are placed into a reception condition. Synchronization information stored in one of the base stations is wirelessly transmitted on the basis of start information communicated from the communication system in this base station. After a reception of the wirelessly transmitted synchronization information with an adequate level in one of the neighboring base stations, receivability information is formed therein and is transmitted to the communication system via trunk lines. After reception of receivability information in the communication system, the appertaining base station is initialized by communicating control information via the trunk lines to synchronize to the wirelessly received synchronization information and to transmit synchronization information stored therein. After reception of receivability information from further base stations, both the synchronization to the respective, wirelessly received synchronization information and the wireless transmission of synchronization information are repeated until all base stations are synchronized to the respective neighboring base station.

Given a reception of at least two receivability information from at least two base stations in the communication system, the appertaining base stations are interrogated with respect to the magnitude of the reception level of the wirelessly communicated synchronization information using level-measuring information communicated via trunk lines as well as using level result information. The base station that reported the highest reception level of the wirelessly received synchronization information is initiated to synchronize to the wirelessly received synchronization information. It is initiated thereto by the communication system by communicating control information via the trunk lines.

Given a reception of the wirelessly transmitted synchronization information with adequate level in at least one of the neighboring base stations, the reception level is measured therein and receivability information and level result information are formed therein and are communicated together to the communication system in terrestrial fashion. The base station that reported the highest reception level of the wirelessly received synchronization information is initiated to synchronize to the wirelessly received synchronization information, being initiated thereto by the communication system on the basis of a terrestrial communication of a control information.

A resynchronization of a base station during operation is implemented in the sequence determined in the initial synchronization, taking the existing master-slave relationships of the neighboring base stations into consideration. A resynchronization of the base station can be temporarily, regularly or constantly implemented.

The wireless synchronization of base stations can be implemented across communication systems.

In one embodiment the information to be wirelessly transmitted is formed according to the DECT standard.

A transmission unit as well as line termination units in the base station are realized by message switching units that can